CLAIMS

What is claimed is:

1. An active electrode array for use with an implantable neural stimulator, wherein the active electrode array comprises at least four banks of active electrodes, wherein each bank of active electrodes includes a plurality of active electrodes, wherein each active electrode comprises a plurality of individual electrode contacts and an active switch integrally formed with the individual electrode contacts for individually activating the plurality of individual electrode contacts with a selected electrode stimulation current in response to electrode control signals.

2. The active electrode array as set forth in Claim 1 wherein the plurality of individual electrodes included within each active electrode comprises at least one lateral electrode contact and at least one medial electrode contact.

3 The active electrode array as set forth in Claim 2 wherein each active electrode includes a silicon die and switching circuitry hermetically sealed on the silicon die and operatively connected to the lateral and medial electrode contacts, wherein the switching circuitry responds to the electrode control signals to selectively activate one or both of the medial or lateral electrode contacts.

4 The active electrode array as set forth in Claim 3 wherein each bank of the active electrodes comprises a stack of the silicon dies of each active electrode belonging to that bank, over-molded with silastic.

5. An active electrode array adapted for use with an implantable tissue stimulating prosthesis, wherein the active electrode array comprises:

a plurality of active electrodes;

wherein each active electrode includes switching circuitry built into the electrode array and a plurality of individual electrode contacts that may be individually activated by electrode control signals applied to the switching circuitry.

6. The active electrode array of Claim 5 wherein the active electrode array includes at least four active electrodes.

7. The active electrode array of Claim 6 wherein the plurality of individual electrode contacts included within each active electrode comprises at least one lateral electrode contact and at least one medial electrode contact.

8. The active electrode array of Claim 7 wherein the switching circuitry of each active electrode comprises:

decoding circuitry,

a first switch coupled to the decoding circuitry and the at least one lateral electrode contact, and

a second switch coupled to the decoding circuitry and the at least one medial electrode contact, wherein the decoding circuitry responds to the electrode control signals and causes the first and second switches to selectively activate one or both of the medial or lateral electrode contacts.

9. The active electrode array of Claim 8 wherein the decoding circuitry and first and second switches of each active electrode are formed on a substrate die, and wherein the medial and lateral electrode contacts of the active electrode are formed on opposing edges of the substrate die, and wherein at least four of said substrate dies are stacked and over-molded with silastic to form the active electrode array.

10. The active electrode array of Claim 9 wherein the active electrode array comprises a plurality of active electrode banks, wherein each active electrode bank includes a plurality of active electrodes.

11. The active electrode array of Claim 10 wherein at least one active electrode in each active electrode bank includes a built-in strain gauge, wherein the strain gauge is adapted to measure stress across the substrate die.

12. An active electrode array comprising

a flexible carrier in which *n+1* wires are embedded, where *n* is an integer of at least 4;

an active electrode array at or near a distal end of the flexible carrier comprising at least 2*n* electrode contacts;

switching circuitry located at or near the distal end of the flexible carrier adjacent the electrode contacts, said switching circuitry being responsive to control signals presented on at least a plurality of the *n+1* wires so as to direct a stimulation signal presented on another of the *n+1* wires to a selected pair of the electrode contacts; and

means for connecting the *n+1* wires at a proximal end of the flexible carrier to electronic circuitry adapted to generate the control signals and stimulation signal;

whereby at least 2*n* electrodes located at the distal end of the flexible carrier may be connected for individual control through no more than *n+1* wires embedded within the flexible carrier..

13. The active electrode array as set forth in Claim 12 wherein the at least 2*n* electrode contacts included within the active electrode array comprises at least *n* lateral electrode contacts and at least *n* medial electrode contacts.

14. The active electrode array as set forth in Claim 13 wherein the switching circuitry comprises a silicon die on which switching circuitry has been formed and hermetically sealed and operatively connected to the lateral and medial electrode contacts, wherein the switching circuitry responds to the electrode control signals to selectively activate selected ones of the medial or lateral electrode contacts.

15. The active electrode array of Claim 12 wherein the switching circuitry of each active electrode comprises:

decoding circuitry,

a first switch coupled to the decoding circuitry and the lateral electrode contact, and

a second switch coupled to the decoding circuitry and the medial electrode contact, wherein the decoding circuitry responds to the electrode control signals and causes the first and second switches to selectively activate one or both of the medial or lateral electrode contacts.

16. The active electrode array of Claim 15 wherein the decoding circuitry and first and second switches of each active electrode are formed on a substrate die, and wherein the medial and lateral electrode contacts of the active electrode are formed on opposing edges of the substrate die, and wherein at least four of said substrate dies are stacked and over-molded with silastic to form the active electrode array.